

REMARKS

Claims 1-43 were previously pending in the present application. Claims 1, 2, 12, 14, 16, 18, 23, 34, 38, and 40 have been amended. Claim 42 has been canceled. Independent claims 1 and 23 have been amended to include limitations previously considered by the Examiner in dependent claims. Reconsideration of the present application in light of the following remarks is respectfully requested.

Rejections under 35 U.S.C. § 102

Claims 1, 2, 4-15, 20-24, 26-37, 42, and 43 are rejected under 35 U.S.C. §102(b) as being anticipated by Raaijmakers et al. (U.S. Patent 6,348,420 hereinafter referred to as “Raaijmakers”). This rejection is respectfully traversed, for the following reasons.

The PTO provides in MPEP § 2131 that

"[t]o anticipate a claim, the reference must teach every element of the claim...."

With respect to independent claim 1, to sustain this rejection the Raaijmakers reference must contain *all of the above claimed elements* of the claim. However, it is respectfully submitted that Raaijmakers does not teach “wherein at least one of the plasma nitridation and the plasma reoxidation is performed at approximately 700°C or lower” as is recited in claim 1. Similarly, with respect to independent claim 23, Raaijmaker does not provide a plasma nitridation or “subjecting the intermediate stacked gate dielectric to a plasma reoxidation process at a temperature at or below approximately 700°C to form the final stacked gate dielectric, wherein the plasma reoxidation is conducted in the presence of a material selected from the group consisting of O₂, N₂O and NO”

The Examiner asserts that the plasma nitridation and plasma reoxidation are provided by “Raaijmakers’ anneal step containing plasma generated nitrogen and oxygen radicals.” Office Action, pg. 3. Emphasis added. Applicant respectfully disagrees. One skilled in the art would find the disclosed anneal of Raaijmakers does not provide for the plasma nitridation or plasma reoxidation as claimed. One would readily appreciate that an anneal process and a plasma

process are distinct. Even assuming, arguendo, that the anneal process includes an atmosphere including radicals, the process is still distinct from a plasma process. Simply put, the presence of radicals does not necessitate a plasma. A plasma may include radicals, but the presence of radicals does not provide for a plasma.

The Applicants, in the Background portion of their specification, discuss the disadvantages of a conventional anneal process including the “thermal budget is kept high due to the necessity of the annealing steps.” Applicants’ [0005]. The Applicants also provides the plasma process reduce the thermal budget. Applicants’ [0026].

Raaijmakers provides, at column 15, lines 21-37 (which is cited by the Examiner as providing the anneal step) the following text (emphasis added):

Following formation of 520, 530 of the dielectric stack, an in situ anneal 535 serves to [densify] the silicon nitride layer. In the illustrated embodiment, silane flow is stopped while nitrogen and ammonia flow are maintained at the same flow rate as during nitride deposition. Preferably after silane is fully purged from the chamber, wafer temperature is ramped from 780° C. to about 900° C. (consuming about 10 seconds for the preferred reactor) and the anneal 535 maintained for about 60 seconds. Advantageously, the wafer is unloaded 540 while the reactor continues to idle at about 900° C., such that, upon unloading the old and loading a new wafer, the new wafer quickly reaches temperature stability. In other arrangements, however, an oxidant (e.g., N₂O, NO, O₂ or O radicals) is instead provided during the anneal 535. In still other arrangements, the anneal 535 includes exposure to a nitriding agent (e.g., NH₃, N₂ or N radicals) followed by exposure to an oxidant.

Thus, the cited embodiment clearly provides an anneal step at a temperature of 900° C.

The Examiner also appears to cite in part to a distinct embodiment of Raaijmakers’ - Example 5. This embodiment also does not provide for the claim. However, the embodiment does provide that “the temperature for this anneal can be lowered considerable by the injection of N radicals to the anneal environment, and is preferably conducted at about 680° C in the illustrated process flow.” Col 21, Ins. 1-4. Raaijmakers provides, in reference to a deposition,

that the temperature may be lowered because “the energy input by the supply of N radicals to the process.” Col. 20, lns. 39-41. Therefore to any extent that the Examiner alleges Example 5 provides for 680° C anneal process, Raaijmakers teaches such an anneal process is provided only by use of energy input from N radicals. Claim 25, for example, clearly requires the plasma reoxidation process occur in the presence of a material selected from the group consisting of O₂, N₂O and NO.

Accordingly, the Raaijmakers reference does not disclose each and every limitation of claims 1 and 23. Therefore, the rejection of claims 1 and 23 under 35 U.S.C. §102 is not supported by the Raaijmakers reference and should be withdrawn.

Dependent Claims

Claims 2-21 and 24-43 depend from, either directly or indirectly, and further limit independent claims 1 and 23, respectively, and thus are in condition for allowance for at least the same reasons as set forth above in claims 1 and 23.

Claims 3 and 25 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Raaijmakers in view of Bloom et al. (US Patent 6,228,779 hereinafter referred to as “Bloom”). Applicant traverses this rejection on the grounds that the depend from and further limit claims 1 and 23, respectively, which are shown above as allowable.

Further, claims 16-19 and 38-41 were rejected under 35 U.S.C. §103(a) as being unpatentable over Raaijmakers. The Examiner indicated that “Raaijmakers teaches a process for forming ultra thin dielectric stacks of high quality aided by plasma energy with an optional anneal step using nitriding and oxidizing agents (i.e. reoxidation step).” (Office Action, pg. 5). However, the Examiner finds Raaijmakers is wholly silent as to temperature and pressure ranges of the reoxidation step. As described above, Raaijmakers teaches an anneal to which the Examiner asserts is the claimed plasma process. The applicants again disagree that an anneal, even including one occurring in an atmosphere including radicals provides for the claimed

plasma process. Furthermore, as described above in Example 2, cited by the Examiner, the anneal temperature is disclosed as 900 C. Raaijmakers discloses the anneal 125, cited by the Examiner, as including one process providing both a nitriding agent and an oxidizing agent. Thus, assuming the anneal includes oxidants happens at the same temperature as the nitride anneal the cited embodiment teaches a 900 C anneal to oxidize. In Example 5, a decrease in anneal temperature (to 680 C) is provided by the injection of radicals (N radicals). Example 5 also provides a decrease in deposition temperature to 650 to 680C. Col. 20, lns. 39-41. Again, this reduction is due to the supply of N radicals present. Col. 20, lns. 39-41. In order for the decrease in temperature in an oxidizing anneal as well, a radial would be also be required.

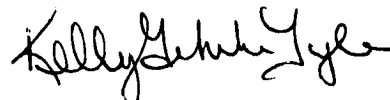
Dependent claims 2-22, 24-41, and 43 are submitted to be allowable as depending from and further limiting allowable independent claims 1 and 23.

Conclusion

All matters set forth in the Office Action have been addressed. Accordingly, it is believed that all claims are in condition for allowance. Favorable consideration and an early indication of allowability are respectfully requested.

Should the Examiner deem that an interview with Applicant's undersigned attorney would expedite consideration, the Examiner is invited to call the undersigned attorney at the telephone number indicated below.

Respectfully submitted,



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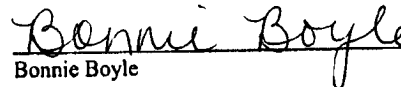
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